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CHEMICAL DEFENCE EXPERIMENTAL ESTABLISHMENT

RADIOLOGICAL DECONTAMINATION

CLOTHING TRIALS (U)

BY

E. NEALE AND K. SINCLAIR

PORTON TECHNICAL PAPER No. (R)33

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Porton Technical Paper No. (R)33

Date 7th March, 1961

RADIOLOGICAL DECONTAMINATION: CLOTHING TRIALS

by

E. Neale and K. Sinclair

SUMMARY

A series of trials in which men crawled for short distances on damp grass contaminated with a simulant representing insoluble particulate fall-out, has demonstrated that very high levels of contamination can result on various parts of the clothing. As would be expected, the heaviest deposits occurred on knees and forearms though considerable contamination was also found on some occasions over the thighs and abdomen.

The contamination levels were frequently such that, in terms of H + 1 hour fall-out, the β dose to the underlying skin would be greatly in excess of that given as permissible, even in an emergency.

Contamination on the combat suit, though often well above the permissible level, was invariably lower and less extensive than that on serge battledress.

Preliminary trials involving decontamination by brushing and by vacuum cleaning, indicated that neither procedure could be relied upon for the removal of contamination associated with moisture and mud. Brushing appeared to be more effective on combat suiting than on serge but vacuum treatment was very inefficient on both types of cloth.

Experience has shown that a proper assessment of decontamination methods will not be possible with the present trials conditions. It will ultimately be necessary either to use a more active simulant or to develop more sensitive methods of measuring contamination.

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EN/KS/DG

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RADIOLOGICAL DECONTAMINATION; CLOTHING TRIALS

by

E. Neale and K. Sinclair

INTRODUCTION

A preliminary note (1) was concerned primarily with the choice of fall-out simulant, with instruments for measuring the contamination and with health physics aspects of the trials. A total of eight trials using simulant particulate fall-out labelled with Na^{24} has now been completed and it is expedient to summarise the information obtained and to consider the objectives of future trials.

PROCEDURE

(a) Simulant

For each trial 15 g of 100 micron glass beads (ballotini) were irradiated at A.E.R.E., Harwell for six hours at a thermal neutron flux of about 10^{11}n/cm^2/sec. Analysis of the glass showed the sodium content to be 3.4 per cent, thus the Na^{24} activity would be about 300 μc per gram of glass at the time of removal from the reactor. For all but the first trial (where untreated beads were used as diluent) the active material was diluted with one hundred times its weight of fluorescent beads (2). On each occasion the trial was carried out about twenty-four hours after removal of the beads from the reactor so that the specific activity of the diluted material at the time of use would be approximately 1.0 μc/g.

In order to check the uniformity of mixing and to provide calibration data for interpretation of results, random samples were taken from the diluted simulant and the count rate of weighed amounts (10-50 mg) checked with a shielded end-window GM tube and scaler. A good linear plot was obtained for each batch although the specific activity varied considerably from trial to trial. This was largely due to the fact that the material was not always removed from the reactor at the same time on the day previous to the trial.

Date	Trial No.	Specific Activity when distributed (cpm/mg)
2.9.60	1	350
23.9.60	2	400
4.10.60	3	620
13.10.60	4	720
20.10.60	5	590
8.11.60	6	1000
22.11.60	7	550
29.11.60	8	630

(b) Distribution

The equipment described in the earlier report was used to distribute the simulant, the approximate surface loading being 5 g/ft^2 on all occasions. Except for the first trial over concrete, the surface was short grass. Unfortunately measurements of surface moisture on the ground were not obtained in the earlier trials although from the appearance of the garments after crawling there is little doubt that the order of wetness was 2>3>4. In the later trials pads of weighed filter paper (each pad comprised six circles of paper of 11 cm diameter) were left in contact with the ground under a 20 kg weight for 10 minutes and reweighed; duplicate measurements showed poor agreement but average values were as follows:-

Trial No.	Surface Moisture
5	3.7 mg/cm^2
7	7.0 " "
8	10.0 " "

A rough check on the distribution of activity was obtained by taking measurements close to the ground with a shielded end-window counter as described in the earlier report.

(c) Type of Clothing and Contamination Procedure

In all trials, one volunteer was dressed in khaki serge battledress; in trials 5-7 a second volunteer wore the army combat suit. For trials 2-4 the second volunteer wore serge battledress with pieces of combat suit cloth pinned over the forearms, thighs, abdomen and knees. Linen skull caps, gloves, overshoes and dust respirators were worn by all persons while crawling in the contaminated area. The exercise for trials No. 2-7 involved a

crawl of about 24 yards (along three parallel lanes each 24 ft long by 2 ft wide), carrying a dummy rifle. In the last trial an attempt was made to obtain information on the relationship between the distance crawled and the degree of contamination; the same person, wearing a different suit of serge battledress on each occasion, carried out three exercises consisting of 8, 16 and 24 yards crawling respectively.

Immediately after the exercise the volunteer went into a dark room for visual examination under a U.V. lamp and the contaminated patches were chalk marked for subsequent assessment by radiac monitoring (see below). The garments were removed for monitoring but in the later trials the trousers were put on again and the knee patches subjected to vigorous brushing (stiff nail brush) or vacuum cleaning for one minute before removal and re-monitoring. The vacuum cleaner, a Hoover Model H.E.1, was the same type as that used in the earlier laboratory studies on clothing decontamination (6); the hose was fitted with an end-piece having a 4" x $\frac{1}{2}$" aperture.

(d) Measurement of contamination on Clothing

In the first report it was shown that a β/γ ratemeter type monitor was insufficiently sensitive for measuring low levels of contamination (with this very low activity simulant) and also that with the normal cylindrical probe it was difficult to control its position in relation to the contaminated surface. An alternative procedure, giving better sensitivity and a precise location of the surface and counter, was to cut the cloth into pieces of a convenient size for mounting in a lead castle with an end-window GM tube and Dekatron scaler, the counting time being varied according to the contamination level. As this was too time consuming for routine examination of garments, with the available resources, a compromise was achieved by attaching an end-window GM tube to a Type 1021B contamination meter or Burndept Ratemeter BN.110. The end-window tube was housed in a heavy brass holder to exclude scattered β radiation and a brass ring on the base served to maintain a constant distance of 1.0 cm between the mica window and the contaminated surface. Fairly precise positioning of the tube was ensured by placing a one-inch grid ruled on polythene film over the area to be examined. A comparison of measurements made in this way with those using the Dekatron scaler and lead castle is given in Appendix I. It will be seen that the coefficient of variation of the ratio between the two sets of results was approximately 7 per cent.

Another possible source of error lies in the fact that contamination can vary between a uniform distribution over the area examined and a concentrated spot on part of the area. Examination of this effect by comparing the count rate on a sample heaped in the centre of the area and spread uniformly over the surface, showed that the difference for contamination densities up to 20 mg/cm^2 did not exceed about 10 per cent, which is acceptable for the present purpose.

On two occasions where monitoring showed heavy contamination, the cloth sample (serge) was boiled with 5 per cent caustic soda to disintegrate it. The solid residue was allowed to settle and the liquid carefully decanted off. The residue, after washing several times with water and acetone, was found to be almost entirely 100 μ glass beads; these were dried and weighed for comparison with the results obtained by monitoring.

RESULTS AND DISCUSSION

(a) Contamination

The results of the first trial (on concrete) have been omitted as they were summarised in the earlier report and further, they are not readily comparable with the results of later trials owing to a change in monitoring procedure. In all seven trials on damp grass, the general pattern of contamination, as shown by examination under ultra-violet light, was similar; knees and forearms were always heavily contaminated while other parts of the body, particularly thighs and abdomen were affected to an extent depending on the build of the individual and his manner of crawling. Heavy contamination was usually associated with wet patches on the clothing. In a few cases where mud also adhered to the cloth this was not necessarily an area of high activity.

It is not convenient to report all results in detail but a number of typical areas, illustrating the pattern of contamination are presented in Appendix II Tables 1-6. Contamination density levels were derived from the observed count rate and the specific activity of the simulant.

In Appendix III, the results of all trials are summarised in terms of (i) the approximate area contaminated (ii) the mean contamination level and (iii) the peak contamination level recorded. The most striking feature of the results is that the khaki serge battledress showed much heavier and more extensive contamination than the combat suit and with the latter there was much less dependence on the surface moisture content (as shown by variation in results from one trial to another). In the few instances where khaki serge was disintegrated in caustic soda and the glass beads recovered, the heavy contamination levels indicated by monitoring were confirmed to within ± 10 per cent by the weight of beads.

In the one trial in which the distance crawled was varied, results were somewhat erratic; while both mean and peak contamination levels showed an increase between 8 and 16 yards crawling, it seems probable that saturation may have been reached at about the latter distance. Further trials are however required to confirm this.

Various estimates have been made of the short term effects of β radiation from fission products on the skin but those of Alpen (3) appear to be most generally accepted:-

Effect of short period exposure of skin to β Radiation

Dose (rad)	Effect
0-600	No acute effect
600-2000	Moderate early erythema
2000-4000	Erythema within 1 day; skin breakdown in two weeks

Assuming that contamination does not occur before H + 1 hour, and taking a value of 200 mc/g as the average β activity of fall-out at this time (4)(5) an estimate has been made of the contamination-dose relationship for various thicknesses of clothing. For this purpose it has been arbitrarily assumed that the clothing remains contaminated (and worn), for a period of seven days. This assumption is of little consequence since a period of one day would only reduce the estimates by 27 per cent while a period of one month would increase them by about 14 per cent.

Clothing weight (mg/cm^2)	Dose received from 1 mg/cm^2 contamination at H + 1 hr
30	3000 rad.
100	1500 "
180	900 "

Taking 100 mg/cm^2 as the weight of combat suiting and 180 mg/cm^2 as that of serge battledress, it will be seen from the results in Appendix III that peak doses could exceed 42,000 rad on troops wearing the combat suit and 40,000 rad on troops wearing serge battledress. Similarly, doses corresponding to the mean contamination levels could be as high as 3,500 rad for the combat suit and 20,000 rad for the battledress. These estimates must of course be considered in conjunction with the whole body γ dose to which the person would be exposed.

There have as yet been no trials to relate the pick-up of contamination on clothing to the density of contamination on the ground; however, the ground contamination density used throughout the present trials (nominally 5 g/ft^2) corresponds to a γ dose rate near the ground of about 200 r/hr at H + 1 hr. Thus during the short time spent crawling, the whole body γ dose would be well within the acceptable limits for wartime.

Fall-out from megaton nuclear weapons would be very wide spread, and speedy evacuation from the contaminated area would be impracticable; under these conditions the γ hazard from fall-out on the ground would be the predominant factor. Data relating to fall-out from tactical nuclear weapons is not at present available, but if the activity and contamination density is similar to that from the larger weapons, but covering a much smaller area, then it seems likely that the major hazard to infantry could arise from the pick-up of contamination on the clothing.

(b) Decontamination

Some typical decontamination results are given in detail in Appendix IV(a) and a summary of all the data is presented in Appendix IV(b). It is evident that much more work is required to cover the many variables which may be expected to affect the efficiency of decontamination but it is clear even from these preliminary tests that the combat suit is more readily decontaminated than the serge battledress. It also appears that if the contamination is associated with moisture and perhaps mud, neither brushing nor vacuum treatment can be relied upon to remove it.

The results obtained in the one trial using the vacuum cleaner are particularly disappointing when compared with the earlier laboratory results (6); however, it should be noted that the laboratory tests were designed to represent the situation in which contamination occurs through exposure while fall-out is descending. In the present trials in which the contamination was picked up from short damp grass, it was inevitably associated with some mud and the colloidal nature of the latter could completely alter the character of the adhesion between the fall-out simulant and the cloth.

A further point worth emphasising is that the conditions chosen for the trials, namely one minute's brushing or vacuum treatment on the knee, probably represents more detailed attention than would be practicable when dealing with the entire suit. Despite this, as will be seen from Appendix IV(a), the percentage removal of contamination was very variable, being for example over 90 per cent at some points and nil at others with brushing on serge battledress.

(c) Future Work

Trials are proceeding to obtain further information on the following aspects of the problem:

(i) The effect of the length of contact (distance crawled) and the level of contamination on the ground, on the amount picked up on clothing.

(ii) The influence of the degree of wetness of the clothing on the pick-up of contamination and its removal.

(iii) Some trials on bare soil have been carried out but the nature of the soil may be important. Since it will be impracticable to include a wide variety of soils in field trials, consideration is being given to the possibility of studying this in the laboratory.

(iv) Although neither simple brushing nor vacuum treatment appear to be very effective, a combined vacuum-brushing technique may be more satisfactory; this possibility will be examined.

(v) Trials on drier ground (grass and bare soil) are obviously required but it is unlikely that these will be possible before early summer.

It will be seen from Appendix II that with the present low activity simulant and existing methods of assessment, it is not possible to measure contamination densities below about 0.3 mg/cm^2; this represents a potential dose to the skin of 250-300 rads through serge battledress or 400-500 rads through the combat suit (H+1 hr contamination). For the measurement of initial contamination on clothing therefore, present methods are adequate. It must however be recognised that the normal procedure for troops suspecting contamination would be to decontaminate at once and undergo monitoring as soon as possible afterwards; the permissible level of contamination must then make allowance for the substantial dose received before decontamination. In this connection Soole (7) suggested that for measurements carried out after decontamination the permissible levels should be one tenth those acceptable for initial contamination. It is evident therefore that before a complete assessment of decontamination methods is possible it will be necessary either to use a more active simulant or to use more sensitive (and hence less simple and rapid) methods of assessment.

A further point which must be borne in mind in the measurement of low contamination densities, is the possible error inherent in the use of a diluent. The present simulant consists of 100 inactive beads to every irradiated bead; so that with a contamination density of 0.03 mg/cm^2 there would be an average of only one active bead to each 5 cm^2 of contaminated surface. The area covered by the end-window GM tube used is in fact approximately 5 cm^2.

CONCLUSIONS

A series of trials involving short distance crawling on damp grass contaminated with a simulant representing insoluble particulate fall-out, has demonstrated that very high levels of contamination can result on various parts of the clothing. As would be expected the heaviest deposits occurred on knees and forearms though considerable contamination was also found on some occasions over the thighs and abdomen.

The contamination levels were frequently such that, in terms of H + 1 hour fall-out, the β dose to the underlying skin would be greatly in excess of that given as permissible, even in an emergency.

Contamination on the combat suit, though often well above the permissible level, was invariably lower and less extensive than that on serge battledress.

Preliminary trials involving decontamination by brushing and by vacuum cleaning indicated that neither procedure could be relied upon for the removal of contamination associated with moisture and mud. Brushing appeared to be more effective on combat suiting than on serge but vacuum treatment was very inefficient on both types of cloth.

Experience has shown that a proper assessment of decontamination methods will not be possible with the present trials conditions. It will ultimately be necessary either to use a more active simulant or to develop more sensitive methods of measuring contamination.

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Appendix I to P.T.P. (R)33

Comparison of Radiation Monitor Type 1021B and Dekatron Scaler with lead castle and head amplifier, each using the same type of end-window GM tube.

Measurements were made on pieces of serge treated with P32 phosphate at various levels of activity. The end-window tube used on the Monitor was shielded with a heavy brass tube and the micawindow maintained at a constant distance of 1.0 cm from the contaminated surface.

Monitor (cps) A	Scaler			Ratio D : A
	B	C	D	
20	1	1232	433	21.7
55	1	3540	1250	22.8
60	1	4174	1470	24.5
65	1	4431	1560	24.0
90	2	1975	1975	21.7
120	2	2764	2764	23.0
210	2	5160	5160	24.5
325	2	7884	7884	24.2
580	2	14170	14170	24.4
1400	4	11836	32200	23.0
1600	4	15085	41000	27.3
1800	4	17990	48800	27.2

B = shelf number in lead castle.

C = observed mean count rate (cpm).

D = Count rate corrected to shelf 2.

Mean Ratio = 24.0 (stand devn. 1.8)
Coefft. of variation = 7.5%.

Appendix II to P.T.P (R)33

Detailed results on typical areas of contaminated clothing.

Results are expressed as contamination densities (mg/cm²) calculated from the observed count rate and the specific activity of the simulant.

(Note:- mean density of contamination on the ground 5 mg/cm²).

Table 1

Trial No. 5. (20th October) Serge Battledress - Right Thigh (Area 8" x 5")

1.5	2.0	2.0	1.5	1.5	2.9	1.7	-
2.3	4.3	6.3	7.4	8.6	9.7	8.6	5.4
6.9	7.1	7.7	9.1	10.0	9.1	10.0	10.9
4.3	5.2	9.7	11.5	10.0	9.1	10.6	10.3
0.7	1.9	3.7	8.6	8.6	10.9	10.9	9.7

Table 2

Trial No. 6. (8th November) Serge Battledress - Left Forearm (Area 6" x 5")

<0.3	0.40	0.45	0.90	0.70	-
0.45	1.2	3.8	6.1	6.1	3.8
0.85	1.5	10.8	23.0	17.0	9.3
0.54	11.5	20.0	28.0	18.5	3.8
-	3.1	9.3	14.5	7.7	1.2

Appendix II (Contd.)

Table 3

Trial No. 7. (22nd November) Serge Battledress -
Right Knee (Area 7" x 6")

1.2	3.5	5.8	5.5	5.7	4.5	0.8
2.5	3.0	12.0	12.5	9.3	7.5	3.7
1.2	5.0	11.5	12.5	11.3	11.3	8.7
1.2	3.0	8.7	10.5	9.5	8.0	10.0
0.6	2.2	5.5	5.0	5.0	7.5	7.5
0.3	0.3	1.0	1.5	2.5	3.5	2.0

Table 4

Trial No. 4. (13th October) Combat Suit
Right Forearm (Area 6" x 5")

-	< 0.3	1.2	4.0	2.8	4.4
< 0.3	0.8	5.0	3.8	4.2	3.4
0.7	2.0	4.0	2.6	3.5	0.7
0.3	2.1	2.8	1.9	0.8	<0.3
-	0.8	1.6	0.3	-	-

Appendix II (Contd.)

Table 5

Trial No. 5. (20th October) Combat Suit - Right Knee (Area 6" x 5")

0.3	0.3	0.4	1.0	0.3	<0.3
2.3	1.7	3.6	3.7	2.4	1.4
0.9	3.9	7.4	6.6	3.1	1.7
<0.3	2.8	4.6	3.7	2.8	3.1
<0.3	1.4	1.0	0.7	1.0	0.7

Table 6

Trial No. 7. (22nd November) Combat Suit - Left Knee (Area 5" x 6")

-	1.2	3.0	1.8	1.4	-
1.8	2.5	3.8	3.3	2.0	1.2
1.2	2.3	3.0	4.0	3.8	2.3
1.8	2.5	3.3	3.5	3.3	1.8
1.1	0.5	2.7	3.5	2.7	1.2
-	-	1.0	1.8	1.2	0.5

Appendix III to P.T.P. (R)33

KHAKI SERGE BATTLEDRESS

Table 1

Approximate Area Contaminated (cm^2)

Trial No.	Forearm		Knee		Thigh		Abdomen*
	R	L	R	L	R	L	
2	120	100	200	200	NM	NM	NM
3	200	200	140	220	180	160	50
4	130	90	160	190	70	90	NM
5	NM	110	300	230	250	280	130
6	130	170	320	300	NM	NM	NM
7	NM	200	300	250	NM	NM	NM
8(i)	NM	130	200	200	NM	NM	NM
8(ii)	NM	130	290	290	NM	NM	NM
8(iii)	NM	130	380	350	380	380	300

Table 2

Mean Contamination levels (mg/cm^2)

Trial No.	Forearm		Knee		Thigh		Abdomen*
	R	L	R	L	R	L	
2	12.7	15.4	22.3	20.7	NM	NM	NM
3	6.0	4.5	12.2	9.8	7.5	5.5	1.5
4	5.1	3.9	3.8	5.3	0.9	1.2	NM
5	NM	10.4	6.9	7.2	5.6	8.4	2.2
6	6.9	7.6	6.1	7.3	NM	NM	NM
7	NM	5.7	5.6	4.8	NM	NM	NM
8(i)	NM	3.2	3.0	3.5	NM	NM	NM
8(ii)	NM	5.6	6.7	4.9	NM	NM	NM
8(iii)	NM	5.3	8.0	4.9	9.6	11.3	4.4

*The 'abdomen' on the battledress refers to the trousers.
NM = not measured.

Appendix III (Contd.)

KHAKI SERGE BATTLEDRESS

Table 3

Maximum contamination levels (mg/cm^2)

Trial No.	Forearm		Knee		Thigh		Abdomen *
	R	L	R	L	R	L	
2	40.8	47.5	43.0	42.1	NM	NM	NM
3	21.4	15.5	18.3	17.7	17.4	16.1	3.3
4	11.1	8.1	8.2	11.1	1.5	2.2	NM
5	NM	23.0	14.3	16.6	11.5	11.5	4.6
6	23.0	28.0	23.1	26.2	NM	NM	NM
7	NM	12.9	12.5	10.3	NM	NM	NM
8(i)	NM	8.0	10.0	10.0	NM	NM	NM
8(ii)	NM	12.0	13.8	12.5	NM	NM	NM
8(iii)	NM	10.7	17.5	13.8	21.0	19.2	12.0

* The 'abdomen' on the battledress refers to the trousers.
NM = not measured.

COMBAT SUIT

Table 4

Approximate Area contaminated (cm^2)

Trial No.	Forearm		Knee		Thigh		Abdomen **
	R	L	R	L	R	L	
2	150	150	150	120	130	70	<30
3	120	110	120	100	70	80	40
4	150	110	220	NM	<30	<30	NM
5	110	100	180	120	70	60	NM
6	70	90	240	230	NM	NM	NM
7	190	150	220	190	100	90	100

** The 'abdomen' on the combat suit refers to the lower front portion of the jacket.
NM = not measured.

Appendix III (Contd.)

COMBAT SUIT

Table 5

Mean contamination levels (mg/cm^2)

Trial No.	Forearm		Knee		Thigh		Abdomen**
	R	L	R	L	R	L	
2	2.1	2.4	2.2	2.4	0.9	1.5	<0.3
3	1.3	1.4	1.5	2.0	0.3	0.4	<0.3
4	2.3	1.8	1.4	NM	0.6	0.5	NM
5	1.3	1.1	2.3	1.8	0.4	0.7	NM
6	1.2	1.6	1.0	1.6	NM	NM	NM
7	1.7	1.6	1.6	2.2	1.8	2.0	1.1

Table 6

Maximum contamination levels (mg/cm^2)

Trial No.	Forearm		Knee		Thigh		Abdomen**
	R	L	R	L	R	L	
2	5.7	8.5	7.0	7.5	3.5	5.3	0.3
3	4.8	6.1	3.8	3.7	0.4	0.6	<0.3
4	5.0	3.0	2.8	NM	1.0	0.8	NM
5	2.6	1.4	7.4	3.7	1.5	2.0	NM
6	2.5	4.2	2.3	3.8	NM	NM	NM
7	3.5	3.0	3.5	4.0	3.8	3.9	1.5

** The 'abdomen' on the combat suit refers to the lower front portion of the jacket.

NM = not measured.

Appendix IV to P.T.P. (R)33

(a) Some Typical Results on Decontamination

Top figures = initial contamination levels (mg/cm^2) derived from count rate.

Lower figures = % removal by brushing or vacuum.

(i) Trial No. 6. (8th November) Serge Battledress - Left Knee Decontamination by Brushing

4.6 90	15.4 96	23.1 83	23.1 37	26.2 44	23.1 13	12.3 0	6.1 0
13.9 95	20.0 77	24.7 25	26.2 9	26.2 12	18.5 0	9.2 8	3.1 0
9.2 80	12.3 56	8.5 0	9.2 0	11.5 47	3.1 0	1.1 21	0.6 25
1.5 80	3.8 84	0.9 0	0.7 0	0.8 20	0.6 12	0.5 14	0.5 33
-	0.5 33	0.5 40	0.5 33	0.5 33	0.4 20	-	-

(ii) Trial No. 7. (22nd November) Combat Suit - Left Knee Decontamination by Brushing

-	1.2 40	3.0 59	1.8 43	1.4 64	-
1.8 57	2.5 65	3.8 66	3.3 54	2.0 62	1.2 41
1.2 60	2.3 66	3.0 71	4.0 63	3.8 54	2.3 80
1.8 78	2.5 70	3.3 77	3.5 64	3.3 69	1.8 57
1.1 80	0.5 62	2.7 81	3.5 71	2.7 73	1.2 50
-	-	1.0 75	1.8 78	1.2 80	0.5 52

Appendix IV (Contd.)

(iii) Trial No. 7. (22nd November) Combat Suit - Right Knee Decontamination by Vacuum Cleaning

-	<0.3 -	0.6 0	0.6 0	<0.3 -	-
<0.3 -	0.6 0	2.0 12	2.0 37	2.0 12	0.5 0
0.8 50	1.0 0	1.8 35	1.5 25	1.8 14	1.5 0
<0.3 -	1.8 29	1.2 20	1.0 0	2.0 0	2.0 0
0.5 0	2.5 40	1.5 17	1.5 17	2.2 11	1.5 0
1.2 40	3.0 42	2.0 12	1.8 0	3.5 21	1.5 17

Appendix IV (Contd.)

(b) Summary of Decontamination Results

(i) Brushing % Removal

Trial No.	Suit	Position	Mean	Maximum	Minimum
5*	Serge B.D.	R. Knee	74	96	20
5*	" "	L. "	72	95	29
6	" "	R. "	44	85	0
6	" "	L. "	33	96	0
7	" "	L. "	25	75	0
5*	Combat	R. "	>82	>95	>60
5*	"	L. "	>78	>93	>50
6	"	R. "	>63	>90	36
6	"	L. "	>82	>93	50
7	"	L. "	64	81	40

*In Trial No. 5 the interval between contamination and decontamination was approximately ½ hour for Serge B.D. and 1 hour for combat suit. In all others the interval was about ½ hour.

(ii) Vacuum Cleaning % Removal

Trial No.	Suit	Position	Mean	Maximum	Minimum
7	Serge B.D.	R. Knee	7	46	0
7	Combat	R. "	15	50	0

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